CRAWFISH CREEK BRIDGE
Yellowstone Roads and Bridges
Spanning Crawfish Creek
on South Entrance Road
Yellowstone National Park
Teton County
Wyoming

HAER No. WY-26

BLACK & WHITE PHOTOGRAPHS

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WRITTEN HISTORICAL & DESCRIPTIVE DATA

Historic American Engineering Record
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HISTORIC AMERICAN ENGINEERING RECORD

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Location:	Spanning Crawfish Creek on South Entrance Road, 1.5 miles north of South Entrance, Yellowstone National Park, Teton County, Wyoming UTM: Huckleberry Mountain, WY, 12/526200/4888550
Date of Construction:	1935-36
Designer:	Architectural plans by W.G. Carnes, Branch of Plans and Design, National Park Service General plans and specifications by G.M. Williams, Bureau of Public Roads
Builder:	Olaf Nelson, General Contractor Carl J. Jensen, Masonry sub-contractor, Denver, Colorado J.L. Cheatham, Bureau of Public Roads, Construction supervisor
Owner:	Yellowstone National Park, National Park Service
Use:	Vehicular bridge
Significance:	Crawfish Creek Bridge typifies the early design philosophy of the National Park Service, which was to use indigenous materials to harmonize man-made features with their natural surroundings. This philosophy is embodied in many of the park's Rustic Style buildings and structures. The collaboration of the National Park Service landscape architects with the Bureau of Public Roads engineers during the 1920s and 1930s produced many fine examples of Rustic Style architecture.
Project Information:	Documentation of Crawfish Creek Bridge is part of the Yellowstone Roads and Bridges Recording Project, conducted during the summer of 1989 by the Historic American Engineering Record, a division of the National Park Service, under the co-sponsorship of Yellowstone National Park, the NPS Roads and Bridges Project, and the NPS Rocky Mountain Regional Office, Denver. Historical research and written narrative by Mary Shivers Culpin, Historian, NPS Rocky Mountain Regional Office. Engineering description by Steven M. Varner, Virginia Polytechnic Institute. Edited and transmitted by Lola Bennett, HAER Historian, 1993.

HISTORY OF SOUTH ENTRANCE ROAD

In 1872 approximately 2,500,000 acres were set aside in northwestern Wyoming Territory as America's first national park, Yellowstone. In the legislation creating the park, one of the tenets, [the park should be] "... set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people ..." led the first superintendent, Nathanial P. Langford, to conceive the idea of a circuit road, which combined with good wagon approach roads, would enable visitors to reach the scientific and scenic wonders of the Yellowstone.[1] Langford's plans were a near mirror image of the road system found in the park over a hundred years later.

The need for the construction of the road system remained a top priority with the first superintendents, but it would be 1878 before Congress appropriated funds for any improvements or protection in the park. The first wagons entered the park in 1877 with one having to be disassembled before it could be taken over the only bridge, Baronett Bridge. Prior to that time and for many years hence on many of the routes, only pack-trains could manage the park "roads".

By the end of 1882, 104 miles of the 140 miles circuit system had been completed, however, the general quality of the roads was poor due to lack of sufficient funds and over ambitious planning. In 1883 the U.S. Army Corps of Engineers assumed the road construction responsibility from the civilian superintendent who was under the direction of the Secretary of the Interior. Their involvement with the road program in Yellowstone lasted for thirty-four years. Fortunately for Yellowstone National Park, the engineering officers who had the most influence on the road projects, Dan Kingman and Hiram Chittenden, developed a philosophy or landscape ethic, which called for the harmonizing the man-made features with the landscape, that would be expanded upon many years later by the landscape architects of the National Park Service.

The idea for a South Entrance Road was first promoted by Captain William A. Jones in his Report Upon the Reconnaissance of Northwestern Wyoming Including Yellowstone National Park Made in the Summer of 1873, but it would be the 1890s before any semblance of a road were built.[2] During these years, most of the visitors arrived via the north and west entrances, but tourists began to use the south entrance by 1890. With urging from the Governor of Wyoming, a Congressional appropriation of $15,000 was granted in 1892 for the construction of a road from the Upper Geyser Basin to the south boundary.[3]

By the turn of the century Army Corps engineer Hiram Chittenden described the South Entrance Road as "... merely grubbed and cleared, with trees and stumps left in middle of roadway most of the distance. The whole road is in a wretched condition and a disgrace to the Government."[4] With a $20,000 appropriation, Chittenden began improvements on the stretch of road between Lake Yellowstone and the Snake River. "Good substantial bridges" were built to span the Lewis River and Crawfish Creek.[5] In 1902 ten bridges and forty culverts were built on the road, with Lewis River Bridge and Crawfish Creek Bridge considered the most important. Lewis River Bridge was a 188-foot wooden bridge resting upon crib piers and two crib abutments; Crawfish Creek Bridge was a 42-foot wooden bridge.[6]

The north and west entrances continued to be the most popular entries into the Park. The South Entrance Road, in 1909, was mostly used by the military personal in their travels to and from the Snake River Soldier Station.[7] In 1912 a road assessment was conducted to determine the suitability from an engineering standpoint of the system for the introduction of automobile traffic in the Park. Army Corps officer Captain Knight concluded that it would be better if the existing system were reconstructed than creating a separate system for motorized vehicles as some had suggested. Captain Knight felt that the South Entrance Road, which was still considered to be of minor importance, needed only partial widening with "some relocations to reduce grades and the replacement of most of the wooden bridges and culverts which are generally in worn-out condition".

By 1915 part of the road had been widened from 12' to 18' and the some of the wooden bridges had been replaced. Thousands of feet of the South Entrance Road was realigned six to seven miles south of the West Thumb and engineers began building 4-foot-high rock retaining walls.[8] By 1917, all but two miles of the road was considered improved in addition to widening, grading and realignments, 18- and 24-inch log and galvanized corrugated iron culverts were installed.[9]

In 1917 Secretary of the Interior Franklin Lane visited the Park and after traveling on the South Entrance Road, he requested "a railing sufficient to hold cars from running over, painted or whitewashed white so as to be easily seen from either direction." He outlined other dangerous road sections on the system.[10]

In 1918, the newly created National Park Service assumed the responsibility for road improvement and construction in Yellowstone National Park. The South Entrance Road still was not heavily traveled by tourists and was considered in fair condition, except for the need for repair to many of the smaller bridges and pole culverts and to the sections of road that were washed out due to very high freshets and excessive rainfall during the spring of 1918.[11]

Lane reaffirmed the Army Corps of Engineers philosophy toward road construction in the Park. In his statement of National Park Policy, he addressed road construction specifically by calling for the harmonizing of roads, trails, buildings and other improvements with the landscape, and the employment of "trained engineers who either possess the knowledge of landscape architecture or have a proper appreciation of the aesthetic value of park lands."[12]

In 1925 the old log Crawfish Creek Bridge was replaced by a 54-foot steel bridge on concrete abutments. The new bridge, which was skewed at 15 degrees to permit the road to be straightened at the crossing, had been relocated from its original site spanning Gardner River in 1919.[13]

LANDSCAPE ARCHITECTS AND THE BUREAU OF PUBLIC ROADS

In 1926 the National Park Service and the Bureau of Public Roads reached an agreement that the Bureau would survey, construct and improve the road system in the Park. As part of the terms of the agreement, the Bureau of Public Roads would provide all of the technical expertise and the National Park Service would provide the design and special treatments pertaining to landscape architecture. The National Park Service landscape architects worked very closely with the Bureau in order for the road system including the bridges to harmonize with the natural features and surroundings. At that time, most of the park roads were considered unimproved and some of the roads were so narrow that they were restricted to one-way traffic. The Bureau initiated the Park survey in 1926 and construction began the following year. The 1926 survey for the South Entrance Road suggested reconstruction for many stretches of the road, widening all sharp curves between West Thumb and Lewis Lake, widening the road between Lewis Lake and the Snake River Station, the replacement of the Lewis River Bridge with a concrete structure, the replacement of twelve small log bridges with concrete culverts, and the replacement of wooden culverts with metal culverts.[14]

During 1930 and 1931 additional survey work was done on the South Entrance Roads, concentrating on the northern portion of the road from West Thumb to Lewis Lake. Surveys on the southern portion were done in 1932. The Lewis River Bridge site was very easily established as being very near the older bridge, but the Crawfish Creek Bridge site took extensive investigation and discussion. The design was finally approved and prepared during the winter of 1933-34. Designs for the bridges were completed by the National Park Service landscape architects--a log structure for Lewis River Bridge and a stone faced concrete structure for the Crawfish Creek crossing.

The newly proposed bridge, which replaced the very narrow steel truss bridge built by the Army Engineers, and others being designed at the time received much attention. The Chief Engineer of the National Park Service felt that it was "... worthwhile, if possible, to utilize a type of architecture that will blend harmoniously with the landscape. On the other hand, it must be realized that a bridge will always look like a bridge no matter what attempts are made to blend it into the surroundings or how much money is expended on it. This fact in many cases has been frankly conceded and steel or concrete types have been adopted. Masonry arches are of course the most desirable for most locations in national parks, where ruggedness of landscape is the rule."[15]

DESIGN AND CONSTRUCTION OF CRAWFISH CREEK BRIDGE

The approved plans for Crawfish Creek Bridge were submitted along with the approved plans for Lewis River Bridge to the Bureau of Public Roads District Office in Denver, Colorado. The project, which was advertised in local newspapers for two weeks, were submitted for bids on September 6, 1934. Three bids, varying from $470,110.00 to $75,035.50, were received. Olaf Nelson, the low bidder, was awarded the contract on September 19, 1934 for construction of the two bridges. Carl J. Jensen of Denver, Colorado, was the sub-contractor for the masonry work.

Upon receiving the contract, Nelson began the production of the aggregates for the masonry, concrete and mortar. Finding the Snake River at a low stage, Nelson erected a small materials plant in the stream just inside the boundary at the south entrance. During the fall of 1934, Nelson moved the aggregate materials to the two bridge sites.

On June 25, 1935, Nelson resumed construction activity on the South Entrance Road bridges. He found securing suitable quality stone for Crawfish Creek Bridge a problem. He finally located a ledge of volcanic stone, partly obsidian, in an outcropping on the west side of Lewis River, just south of the mouth of the Crawfish Creek, approximately one-quarter mile from the bridge site. Nelson located a masonry crew camp near the quarry cite. His general road camp was on a hill west of the project, near the north end of Lewis River Canyon.

The contractor began the construction by drilling as deeply as was considered safe and shooting the rock in preparation for the abutments excavation. Much of the material was removed by power shovels and trucks. Some of the material had to be removed by hand labor methods and stock piled near the site for use later as backfill. The construction procedure followed this sequence:

> Abutment forms were built, reinforcing steel was placed, and the concrete abutments poured, after which a few day's delay occurred by failure to have all of the arch ring stones cut and ready for installation upon the completion of the erection of the arch barrel form. The arch ring stones were hauled to the bridge site on trucks, hoisted and swung into place by the use of a long boom. As soon as the arch ring stones were set, the arch barrel was poured and work began on the masonry facing. As the masonry facing was laid up, forms were erected and the concrete spandrel walls and tie beams were poured. During the 1935 construction season, all concrete on this bridge was poured, most of the masonry and masonry facing was completed, and waterproofing of the arch barrel and spandrel walls was begun.[16]

The contractor worked on both of the bridges at the same time during 1935. He started the 1936 construction year on June 15 and completed the projects on July 25, 1936. Mr. Nelson

completed the proposed 200 calendar day project in 162 days for an actual cost of $34,206.00 against the estimated cost of $35,932.50. This cost included:

Unclassified excavation	450.75
Unclassified excavation for structure	834.80
Class A concrete	13695.00
Masonry	4492.40
Reinforcing steel	2590.94
Masonry facing	4273.50
Arch Ring Stones	5518.40
Waterproofing	487.50
Sample masonry wall	84.21
Removal of old structure	750.00

The Crawfish Creek Bridge is a 72-foot, concrete, three-centered arch bridge, with a width between curbs of 24'. The structure length is 140'. There is a 15-foot rise of the arch above the spring line and the intrados radii are 30'-4" and 62". The roadway and curbs are on a 400-foot vertical curve with the top of the rail on a vertical tangent of 2.545 percent. The masonry facing of this bridge is 20" wide. The masonry bridge rail is 3'-1" above the deck. The rail is 20" wide and has a curb 8" wide and 11" high. The concrete barrel is approximately 1'-6" thick vertically while the concrete spandrel walls are approximately 1'-6" thick horizontally. The volume between the spandrels and the barrel are backfilled with earth.[17] All parts of the bridge, except the wings, were built to the planned dimensions as suitable material for footings for the abutments were found at the elevations shown on the plans for the bridge. The footings for the masonry wings were found at higher elevations than had been planned, thus the use of less masonry than was planned and in turn a lesser cost than estimated. The specifications called no apparent difference in the exposed faces of the wings and spandrel walls.

The stone found in the nearby quarry was dark in color and it had a very rough surface texture thus necessitating a change order on the contract. Originally the specifications prohibited the use of "rectangular stones with right angle corners in the exposed faces of the masonry, and required that at least 50 percent of the wall surface should be of weathered stones", but it became certain that obtaining stones of five sides or more would prove difficult, thus rectangular stones were used at no additional cost by the contractor. A new architectural sketch was prepared illustrating the revision.

While no unusual conditions were faced on the construction of the bridge and ordinary construction techniques were used, a masonry inspector was required to be on site whenever masonry was being laid. J.L. Cheatham personally supervised the projects with the assistance of one senior levelman and two senior rodmen. Upon completion of the bridge, Cheatham gave it high praises and stated that it "blended well with the adjacent outcropping ledges of stone in the banks of the stream, and the other natural surroundings."[18] "The stone work on the Crawfish Creek Bridge is exceptionally good and, because of its coloring, fits well with the natural surroundings" wrote BPR engineer C.F. Capes in his final report on the project.[19] Sanford Hill, the Park Landscape Architect called it "... very pleasing and one of the best bridges in the Park."[20]

RECENT HISTORY OF SOUTH ENTRANCE ROAD

By 1941 the most southerly portion of the South Entrance Road had been improved to 22-foot width bituminous surface with gravel shoulders on an originally graded 26-foot shoulder

width. The northern half of the road was graded to a 28-foot shoulder width.[21] During the 1940 and 1950s, extensive surfacing projects were conducted on the South Entrance Road and the replacement of the guard rail, improved drainage and shoulders were carried out. In 1960, the log Lewis River Bridge was replaced leaving the third-generation Crawfish Creek Bridge as the reminder of the collaboration of the Bureau of Public Roads engineers and the National Park Service landscape architects. In 1976, some road relocation and reconstruction was done on the South Entrance Road, including widening some sections to 30' shoulder to shoulder. Some work was done to drainage structures.[22]

In the 1980s the South Entrance Road serves as the principal route from the south and is the sole access route from Yellowstone National Park to Grand Teton National Park via the John D. Rockefeller Parkway. The 21.45-mile route, which received considerable surface reconstruction in 1985, is considered a National Park Service Standard Class I (principal park) Road. The first segment of the road begins at the West Thumb Junction and is considered a portion of the West Thumb Bypass. The 1.98-mile segment of road has a roadway width of 28' to 31' and is surfaced with a bituminous plant mix. The shoulder width ranges from 3' to 5.5' and the posted speed limit is 45 mph. This segment of the road was reconstructed in the mid-1960s as a part of the West Thumb Bypass project. Two bridges built in the 1960s, Unnamed Creek Bridge and Thumb Creek Bridge are on this section. Unnamed Creek Bridge is a 3-span continuous concrete T-beam structure, 145' in length with a deck width of 34.2', curb to curb. The bridge has steel railings. The Thumb Creek Bridge is a 3-span continuous concrete T-beam structure 212' in length, with a deck width of 34' curb-to-curb. The bridge has steel railings.

The second segment of the South Entrance Road is 9.30 miles in length running from near the junction of the Grant Road to the Lewis River Bridge. The roadway width shoulder to shoulder is 24' with a surface of bituminous plant mix. The shoulders are 1' wide. There are no bridges on this segment.

The third and last segment of the South Entrance Road is 10.17 miles in length and runs from the Lewis River Bridge to the south park boundary. The roadway width is 24' shoulder to shoulder with a surfacing of bituminous plant mix. The shoulder width is 1'. This segment has one modern bridge (Lewis River Bridge) and one historic bridge (Crawfish Creek Bridge). Lewis River Bridge, built in 1960, is a 5-span continuous steel stringer with concrete deck, 275' long with a deck width of 28.2' curb to curb. A 3-foot sidewalk flanks the traffic lanes. The rails are steel. Crawfish Creek Bridge, built in 1936, is a single-span earth filled concrete arch with stone masonry side walls and parapets. The structure is 140' in length and has a deck width of 24' curb to curb. The bridge has stone masonry parapet guard walls.[23]

ENDNOTES

1.The Organic Act creating Yellowstone National Park was approved on March 1, 1872.

2.William A. Jones, Captain, Report Upon the Reconnaissance of Northwestern Wyoming Including Yellowstone National Park Made in the Summer of 1873. (Washington D. C.: Government Printing Office, 1875), p. 58.

3.W. A. Jones, Major, Construction and Improvement of Roads and Bridges in Yellowstone National Park. Appendix EEE (Annual Report of the Chief of Engineers for 1892), (Washington D. C.: Government Printing Office, 1893).

4.Hiram Chittenden, Improvement of the Yellowstone National Park, Including the Construction, Repair and Maintenance of Roads and Bridges. (Annual Report of the Chief of Engineers for 1900, Appendix LLL) (Washington D. C.: Government Printing Office, 1900)

5.Letter to General --Gillespie, Chief of the U.S. Army Corps of Engineers from Army Engineering Officer, Hiram Chittenden, December 7, 1901.

6.Captain Hiram Chittenden, Annual Report Upon the Construction, Repair, and Maintenance of Roads and Bridges In The Yellowstone National Park, Being Appendixes FFF and III of the Annual Report of the Chief of Engineers for 1902. (Washington D. C.: Government Printing Office, 1902), p. 3036.

7.The United States Army took over the administration of Yellowstone National Park in 1886, just three years after the Corps of Engineers assumed responsibility for road construction. A series of soldier stations were built throughout the Park for protection purposes.

8.Memorandum for all Engineers, Overseers and Foremen Under the Engineer Department, Yellowstone Park. May, 1915.

9.Lt. Colonel Amos Fries and Colonel George Zinn ?, "Report Upon the Construction, Repair, and Maintenance of Roads and Bridges in the Yellowstone National Park and Report Upon the Crater Lake National Park", (Washington D. C.: Government Printing Office, 1917).

10.Memorandum from Acting Director Horace Albright to Lt. Colonel Amos Fries, U. S. Army Corps of Engineers, October 9, 1917.

11.Major G. E. Verrill and Colonel George Zinn, "Report Upon the Construction, Repair, and Maintenance of Roads and Bridges in the Yellowstone National Park and Report Upon Crater Lake National Park", (Washington D. C.: Government Printing Office, 1918).

12.Report of the Director of the National Park Service to the Secretary of the Interior for the Fiscal Year Ended June 30, 1918, (Washington D. C.: Government Printing Office, 1918), p. 274.

13."Annual Report of the Superintendent of Yellowstone National Park for 1925", p. 9.

14.Letter from Horace Albright, Superintendent of Yellowstone National Park, to Mr. J. W. Johnson, District Engineer, Bureau of Public Roads, March 11, 1926. "Tentative Suggestions for Improvements to Park Roads".

15.Frank Kittredge, "Preserving a Valuable Heritage", Civil Engineering, September 1932. pp. 536-37.

16.J. L. Cheatham, "Final Construction Report (1935-36) on Project NR-4-A2 Bridges of The South Entrance Highway Yellowstone National Park Wyoming, April 14, 1937".

17."Architectural Plans, Crawfish Creek Bridge, May 1, 1934", National Park Service, Branch of Plans and Designs.

18.Cheatham, "Final Construction Report (1933-36) on Project NR-4-A2 Bridges of The South Entrance Highway Yellowstone National Park Wyoming, April 14, 1937".

19.Ibid.

20.Sanford Hill, "Monthly Narrative Report to Chief Architect Through the Superintendent on Minor Roads and Trails and Projects Other Than E. C. W for Yellowstone National Park Period: June 24th to July 25, 1936".

21.Mr. B. W. Matteson, District Engineer, Public Roads Administration to Dr. L. I. Hewes, Chief, Western Region, Public Roads Administration, April 9, 1941.

22.Fixed Property Record for South Entrance Road, Yellowstone National Park, September 9, 1976. Rocky Mountain Regional Office, Yellowstone National Park.

23.Parkwide Road Engineering Study of the Yellowstone National Park Road System, Draft Report, October 1986. U. S. Department of Transportation, Federal Highway Administration, Vancouver, Washington, 1986.